WHAT IS CLAIMED IS:

1. An optical microscope apparatus comprising illuminating means for emitting as illumination light a convergent beam converging at a point in a space; a sample mounting table for mounting a sample in front of said converging point of illumination light; and an objective lens disposed such that said illumination light is incident thereon after light transmitted through or reflected by said sample is once converged at said converging point.

2. An optical microscope apparatus according to claim 1, wherein said objective lens is adapted to be focused on each of a diffraction image plane, orthogonal to an optical axis of said illumination light, including said converging point, and said sample.

3. An optical microscope apparatus according to claim 2, further comprising a spatial filter, disposed at a position of said diffraction image plane, for selectively blocking a part of said illumination light transmitted through or reflected by said sample.

4. An optical microscope apparatus according to claim 3, further comprising an adjusting mechanism adapted to arbitrarily change a distance between said diffraction image plane and said sample.

5. An optical microscope apparatus according to claim 4, further comprising an adjusting mechanism for substantially aligning a direction of light transmitted

through said spatial filter and an optical axis of said objective lens with each other.

6. An optical microscope apparatus according to claim 1, wherein said illumination light is monochromatic light.

7. An optical microscope apparatus according to claim 1, further comprising a polarizer disposed between said illuminating means and sample mounting table, and an analyzer disposed between said sample mounting table and eyepiece.

8. An optical microscope apparatus according to claim 7, wherein said polarizer and said analyzer are rotatable about an optical axis of incident light.

9. An optical microscope apparatus according to claim 7, wherein said sample mounting table is rotatable about an optical axis of incident light.

10. An optical microscope apparatus according to claim 7, wherein each of said polarizer and analyzer is a linearly polarizing device.

11. An optical microscope apparatus according to claim 7, wherein one of said polarizer and analyzer is a circularly polarizing device, whereas the other is a linearly polarizing device.

12. An optical microscope apparatus according to claim 7, wherein each of said polarizer and analyzer is a circularly polarizing device.

13. An optical microscope apparatus according to claim 7, wherein said objective lens is adapted to be focused on each of a diffraction image plane, orthogonal to an optical axis of said illumination light, including said converging point, and said sample.

14. An optical microscope apparatus according to claim 13, further comprising a spatial filter, disposed at a position of said diffraction image plane, for selectively blocking a part of said illumination light transmitted through or reflected by said sample.

15. An optical microscope apparatus according to claim 14, further comprising an adjusting mechanism adapted to arbitrarily change a distance between said diffraction image plane and said sample.

16. An optical microscope apparatus according to claim 15, further comprising an adjusting mechanism for substantially aligning a direction of light transmitted through said spatial filter and an optical axis of said objective lens with each other.

17. An optical microscope apparatus according to claim 16, wherein said illumination light is monochromatic light.

18. An optical microscope apparatus according to claim 1, further comprising and a phase plate, disposed on a diffraction image plane, for causing direct light incident on and near said converging point or light incident on the

other region to shift its optical phase from one of being incident, said diffraction image plane being orthogonal to an optical axis of said illumination light and including said converging point; wherein said illuminating means emits monochromatic light.

19. An optical microscope apparatus according to claim 18, wherein said illuminating means comprises a light source for emitting white light, and a monochromating device disposed behind said light source.

20. An optical microscope apparatus according to claim 18, wherein said phase plate causes said direct light incident on and near said converging point and light incident on the other region to have respective optical phases different from each other by about $\pi/2$.

21. An optical microscope apparatus according to claim 20, wherein said phase plate also has a function of attenuating an intensity of light incident on and near said converging point.

22. An optical microscope apparatus according to claim 18, wherein said objective lens is adapted to be focused on each of said diffraction image plane and said sample.

23. An optical microscope apparatus according to claim 22, further comprising a spatial filter, disposed nearly at a position of said diffraction image plane, for selectively blocking a part of said illumination light transmitted through or reflected by said sample.

24. An optical microscope apparatus according to claim 23, further comprising an adjusting mechanism adapted to arbitrarily change a distance between said diffraction image plane and said sample.

25. An optical microscope apparatus according to claim 24, further comprising an adjusting mechanism for substantially aligning a direction of light transmitted through said spatial filter and an optical axis of said objective lens with each other.

26. An optical microscope apparatus according to claim 1, further comprising a linearly polarizing device disposed near said converging point on a diffraction image plane, orthogonal to an optical axis of said illumination light, including said converging point; and a linear polarization analyzer disposed between said diffraction image plane and eyepiece so as to be rotatable about an optical axis of the incident light.

27. An optical microscope apparatus according to claim 26, wherein said objective lens is adapted to be focused on each of said diffraction image plane and said sample.

28. An optical microscope apparatus according to claim 27, further comprising a spatial filter, disposed nearly at a position of said diffraction image plane, for selectively blocking a part of said illumination light transmitted through or reflected by said sample.

29. An optical microscope apparatus according to

claim 28, further comprising an adjusting mechanism adapted to arbitrarily change a distance between said diffraction image plane and said sample.

30. An optical microscope apparatus according to claim 29, further comprising an adjusting mechanism for substantially aligning a direction of light transmitted through said spatial filter and an optical axis of said objective lens with each other.

31. An optical microscope apparatus according to claim 30, wherein said illumination light is monochromatic light.

32. A microscope observing method using an optical microscope apparatus comprising illuminating means for emitting as illumination light a convergent beam converging at a point in a space; a sample mounting table for mounting a sample in front of said converging point of illumination light; an objective lens disposed such that said illumination light is incident thereon after light transmitted through or reflected by said sample is once converged at said converging point; and a spatial filter, disposed at a position of a diffraction image plane, for selectively blocking a part of said illumination light transmitted through or reflected by said sample, said diffraction image plane being orthogonal to an optical axis of said illumination light and including said converging point; said objective lens being adapted to be focused on each of said diffraction image

plane and said sample;

said method comprising the steps of focusing said objective lens onto said diffraction image plane so as to observe a diffraction image of said sample formed on said diffraction image plane by said illumination light and adjusting said spatial filter such that only light from a desirable region of said diffraction image is transmitted therethrough; and then focusing said objective lens onto said sample so as to observe said sample with said light transmitted through said spatial filter.

33. A microscope observing method using an optical microscope apparatus comprising illuminating means for emitting as illumination light a convergent beam converging at a point in a space; a sample mounting table for mounting a sample in front of said converging point of illumination light; an objective lens disposed such that said illumination light is incident thereon after light transmitted through or reflected by said sample is once converged at said converging point; a polarizer disposed between said illuminating means and sample mounting table; an analyzer disposed between said sample mounting table and eyepiece; and a spatial filter, disposed at a position of a diffraction image plane, for selectively blocking a part of said illumination light transmitted through or reflected by said sample, said diffraction image plane being orthogonal to an optical axis of said illumination light and including

said converging point; said objective lens being adapted to be focused on each of said diffraction image plane and said sample;

said method comprising the steps of focusing said objective lens onto said diffraction image plane so as to observe a diffraction image of said sample formed on said diffraction image plane by said illumination light and adjusting said spatial filter such that only light from a desirable region of said diffraction image is transmitted therethrough; and then focusing said objective lens onto said sample so as to observe said sample with said light transmitted through said spatial filter.

34. A microscope observing method using an optical microscope apparatus comprising illuminating means for emitting as illumination light a monochromatic convergent beam converging at a point in a space; a sample mounting table for mounting a sample in front of said converging point of illumination light; an objective lens disposed such that said illumination light is incident thereon after light transmitted through or reflected by said sample is once converged at said converging point; a phase plate, disposed on a diffraction image plane, for causing light incident on and near said converging point or light incident on the other region to shift its optical phase from one of being incident, said diffraction image plane being orthogonal to an optical axis of said illumination light and including

said converging point; and a spatial filter, disposed at a position of a diffraction image plane, for selectively blocking a part of said illumination light transmitted through or reflected by said sample; said objective lens being adapted to be focused on each of said diffraction image plane and said sample;

said method comprising the steps of focusing said objective lens onto said diffraction image plane so as to observe a diffraction image of said sample formed on said diffraction image plane by said illumination light and adjusting said spatial filter such that only light from a desirable region of said diffraction image is transmitted therethrough; and then focusing said objective lens onto said sample so as to observe said sample with said light transmitted through said spatial filter.

35. A microscope observing method using an optical microscope apparatus comprising illuminating means for emitting as illumination light a convergent beam converging at a point in a space; a sample mounting table for mounting a sample in front of said converging point of illumination light; an objective lens disposed such that said illumination light is incident thereon after light transmitted through or reflected by said sample is once converged at said converging point; a linearly polarizing device disposed near said converging point on a diffraction image plane, said diffraction image plane being orthogonal to an optical axis

of said illumination light and including said converging point; a linear polarization analyzer disposed between said diffraction image plane and eyepiece so as to be rotatable about an optical axis of said objective lens; and a spatial filter, disposed at a position of said diffraction image plane, for selectively blocking a part of said illumination light transmitted through or reflected by said sample; said objective lens being adapted to be focused on each of said diffraction image plane and said sample;

said method comprising the steps of focusing said objective lens onto said diffraction image plane so as to observe a diffraction image of said sample formed on said diffraction image plane by said illumination light and adjusting said spatial filter such that only light from a desirable region of said diffraction image is transmitted therethrough; and then focusing said objective lens onto said sample so as to observe said sample with said light transmitted through said spatial filter.

36. A microscope observing method using an optical microscope apparatus comprising illuminating means for emitting as illumination light a convergent beam converging at a point in a space; a sample mounting table for mounting a sample in front of said converging point of illumination light; an objective lens disposed such that said illumination light is incident thereon after light transmitted through or reflected by said sample is once converged at said

converging point; and a spatial filter, disposed at a position of a diffraction image plane, for selectively blocking a part of said illumination light transmitted through or reflected by said sample, said diffraction image plane being orthogonal to an optical axis of said illumination light and including said converging point; said objective lens being adapted to be focused on each of said diffraction image plane and said sample;

said method comprising the step of changing the position of converging point of illumination light in the direction of optical axis of said objective lens to adjust the size of diffraction image.

37. A microscope observing method using an optical microscope apparatus comprising illuminating means for emitting as illumination light a convergent beam converging at a point in a space; a sample mounting table for mounting a sample in front of said converging point of illumination light; an objective lens disposed such that said illumination light is incident thereon after light transmitted through or reflected by said sample is once converged at said converging point; a polarizer disposed between said illuminating means and sample mounting table; an analyzer disposed between said sample mounting table and eyepiece; and a spatial filter, disposed at a position of a diffraction image plane, for selectively blocking a part of said illumination light transmitted through or reflected by said

sample, said diffraction image plane being orthogonal to an optical axis of said illumination light and including said converging point; said objective lens being adapted to be focused on each of said diffraction image plane and said sample;

said method comprising the step of changing the position of converging point of illumination light in the direction of optical axis of said objective lens to adjust the size of diffraction image.

38. A microscope observing method using an optical microscope apparatus comprising illuminating means for emitting as illumination light a monochromatic convergent beam converging at a point in a space; a sample mounting table for mounting a sample in front of said converging point of illumination light; an objective lens disposed such that said illumination light is incident thereon after light transmitted through or reflected by said sample is once converged at said converging point; a phase plate, disposed on a diffraction image plane, for causing light incident on and near said converging point or light incident on the other region to shift its optical phase from one of being incident, said diffraction image plane being orthogonal to an optical axis of said illumination light and including said converging point; and a spatial filter, disposed at a position of said diffraction image plane, for selectively blocking a part of said illumination light transmitted

through or reflected by said sample; said objective lens being adapted to be focused on each of said diffraction image plane and said sample;

said method comprising the step of changing the position of converging point of illumination light in the direction of optical axis of said objective lens to adjust the size of diffraction image.

39. A microscope observing method using an optical microscope apparatus comprising illuminating means for emitting as illumination light a convergent beam converging at a point in a space; a sample mounting table for mounting a sample in front of said converging point of illumination light; an objective lens disposed such that said illumination light is incident thereon after light transmitted through or reflected by said sample is once converged at said converging point; a linearly polarizing device disposed near said converging point on a diffraction image plane, said diffraction image plane being orthogonal to an optical axis of said illumination light and including said converging point; a linear polarization analyzer disposed between said diffraction image plane and eyepiece so as to be rotatable about an optical axis of said objective lens; and a spatial filter, disposed at a position of said diffraction image plane, for selectively blocking a part of said illumination light transmitted through or reflected by said sample; said objective lens being adapted to be focused on each of said

diffraction image plane and said sample;

said method comprising the step of changing the position of converging point of illumination light in the direction of optical axis of said objective lens to adjust the size of diffraction image.